PRESCRIBED BURNING IN THE SOUTH -- TRENDS AND REGULATIONS[1]

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Abstract -- Advances have been made in prescribed burning methodology during the eighties. General attitudes toward fire and toward those people who use it have improved. Public understanding of the ecological importance of fire seems to be growing. However, concerns about effects of prescribed fire on air quality and highway safety remain and State and Federal regulations will be strengthened. Nonetheless, I predict that prescription burning will continue to be an important resource management tool in the coming decade.

INTRODUCTION

To gain a sense of how prescribed burning may fare in the coming years, you must examine the dramatic changes in fire application that occurred during the past decade. The 1980's began with many natural resource managers expecting a significant decrease in the acreage treated with prescribed fire. These projections were based, at least in part, on the belief that companies and agencies doing prescribed burning were already utilizing most good burning days, that state and federal regulations would narrow the window of acceptable burning conditions, and that herbicides would continue to replace fire in many vegetation control situations.

These predictions proved wrong. Southern forestland treated by prescribed fire each year is currently estimated to be around 4 million acres, roughly 1 million acres above estimates made in the 1970's. Some of this apparent increase resulted from better record keeping, but much of it was real. The actual increase can be attributed to a number of technical, social, and political events that had a significant impact on the ecological and environmental implications of fire and its use.

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Aerial Ignition

At the beginning of the 1980's, several Southern State forestry agencies and pulp and paper companies were testing aerial ignition techniques imported from Australia and Canada. These field trials were highly successful. Grid ignition rapidly became the method of choice for many public and private resource managers. It appeared that the lack of adequate burning weather would no longer be a deterrent to meeting planned acreage goals because of the large increase in acreage that could now be treated during a given burning period. In addition, higher fuel moistures could not only be tolerated but were often preferred. The prescribed burning window, therefore, was expanded and "ideal" line-backfiring weather could be utilized solely for the most difficult burns.

Grid ignition in general gives the prescribed burner much more flexibility. When properly executed, point source fires produce an intensity between that of line-heading, and line-backing fires. Prescribed burners can utilize this knowledge to switch from one firing technique to another as burning conditions change throughout the day.

Public Awareness

Ecological concerns and activism reached new heights during the 1980's. In some cases, traditional uses of prescribed fire were repackaged to make the positive relationship between fire and new buzzwords such as biodiversity and landscape ecology more obvious. Sometimes people need to be reminded of the tremendous impact fire exerts in regulating natural processes, and in shaping and maintaining the structure of plant and animal communities (see e.g., Wade and others 1980; Wright and Heinselman 1973). In response to concerns voiced by the public about possible adverse effects of some vegetation management methods, the US Forest Service developed environmental impact statements for the alternative methods of achieving vegetation management objectives on the national forests and grasslands in its Southern Region (USDA Forest Service, 1989a, 1989b). The management alternatives chosen eliminate high intensity prescribed fires and put tighter constraints on the use of herbicides, relying instead on low to moderate intensity prescribed fires to meet stated goals.

A renewed appreciation of the natural role of fire has occurred nationwide. Resource managers in the Intermountain West concluded that restoring the historic role of fire to many ecosystems in their region was highly desirable and possibly necessary, albeit difficult to accomplish. Prescribed fire was advocated as a cornerstone of wilderness management in many western parks. The controversy surrounding the 1988 Yellowstone fires focused public attention on fire management policies (the December 1989 Journal of Forestry was devoted to this issue), but the underlying fire ecology principles once again proved valid. Some ecosystems have evolved with periodic low-intensity fires, while others are adapted to high-intensity stand replacement fires.

Summer Burning

Summer burning is another issue that surfaced in the eighties. Historically, most burns in the south were prescribed to reduce the hazardous accumulation of live and dead fuels. Winter burning is appropriate to meet this objective. Fires are easier to conduct and control during the winter, in part because weather forecasts of precipitation and wind are more likely to be correct. That is why, as the use of fire expanded to include new objectives, dormant-season burns continued to be utilized whenever possible. However, some objectives just could not be met with winter burns. For example, most southern herbaceous species evolved in close association with fire. The vast majority of natural fires occurred during the growing season. Many plants including numerous species currently classed as rare and endangered, were simply victims of attempted fire exclusion or altered fire seasonality. The simple procedure of timing fire to plant phenology has been instrumental in increasing the abundance of many plants, especially herbaceous species. Robbins and Myers (1989) reviewed the seasonal effects of prescribed burning in Florida. Phil Doerr (this conference) touched upon the close beneficial relationship between the red-cockaded woodpecker (a rare and endangered animal species) and periodic fire.

Effects on Southern Pine

The magnitude and duration of southern pine growth responses to various levels of fire damage received much attention. Wade and Johansen (1986) reviewed the subject. In general, available information suggests that multiple low-intensity dormant season fires have little effect on tree growth (e.g., Hunt and Simpson 1985). However, Boyer (1987) and Zahner (1989) documented reduced growth of longleaf pine (*Pinus palustris* Mill.) after several supposedly benign fires. These reports are somewhat troubling because we would like to believe that the effects of fires in fire-driven ecosystems such as those dominated by longleaf pine, are all beneficial. What we have to remember is that fast growth is a useful trait from a management standpoint but not necessarily from an ecological standpoint. Weise and others (in press) found that young loblolly (*P. taeda* L.) and slash (*P. elliottii* Engelm.) pines should survive complete defoliation during all seasons except early fall, if buds are not damaged. Fall defoliation is particularly devastating to loblolly pine.

Effects on Soil

Research during the 1980's filled many gaps in our knowledge base about the effects of fire on soil, but many important questions remain. Kellman and others (1987) related nutrient cycling to underburning in pine stands in Belize. Their conclusions are relevant to Southern U.S. conditions as well. They found that annual burning of pine savannas resulted in a graminoid understory that was almost totally consumed in every fire. Less frequent burning cycles allow formation of a relatively non-flammable shrub layer. This understory is capable of storing a much greater share of a site's nutrient capital than is the graminoid layer (except for phosphorus which is unlikely to be lost from the site because it is rapidly immobilized by soil). Low-intensity fires will topkill but not consume the shrub stratum so nutrients tied up in this vegetation are not released all at once. Rather, they are mineralized over the ensuing months as the scorched leaves and fire-killed

stems decompose. This gradual nutrient release significantly increases the probability that these minerals will again be captured by plants rather than leached from the site. Christensen (1987) reported that species inhabiting fire-dominated ecosystems in the Southeastern U.S. appear to have developed traits that enable them to more efficiently retain and utilize fire-released nutrients. Moreover, periodic low-intensity underburning was found to have no deleterious effects on southern coastal plain soils (McKee 1982). To the contrary, McKee found available phosphorus levels increased and basic cations, especially calcium, were released, which otherwise would become immobilized in the litter layer. Even though the increase in pH is minor, Ralston and others (1982) speculate that release of these basic elements could have a significant impact on the effects of "acid rain" by neutralizing the acidic components in precipitation.

Effects on Air Quality

The temporary effects of prescribed fire on local and regional air quality are well recognized. Methods and techniques to mitigate these effects continue to be developed (Ward in press). Transition in Federal standards for measuring allowable particulate emissions from TSP (total suspended particulate) to PM10 (particulate matter less than 10 microns in size) in 1987 was fairly smooth in the Southern States even though, or perhaps because, it gave the States responsibility for setting limits. Most Southern State air quality agencies recognize the usefulness of prescription fire in natural resource management, particularly to reduce wildfire potential. They, therefore, have cooperated closely with agencies involved with fire management to formulate regulations that all can accommodate.

Each State currently has the responsibility to submit a plan that contains baseline information for the prevention of significant deterioration (PSD). After a baseline date (1/6/75 for particulates), increases in emissions of a pollutant from any source within a defined geographical area will be counted as part of the maximum allowable increase. States with EPA approved PSD plans, however, may exclude certain emission-producing activities from these increment determinations. Many States have, at least for the time being, exercised this prerogative to exclude prescribed fire.

Proposed Federal revisions of PSD increments for particulate (see Federal Register 54[192]:41218-41232 Oct.6, 1989) have raised serious concern among fire managers, however. The National Wildfire Coordination Group (NWCG) has been working with EPA in an effort to have prescription fires federally exempted from PSD increment consumption. Three of the options the EPA has are to: 1) categorically exclude prescription fire, 2) make exclusion contingent upon fire being the "best management practice" or, 3) leave responsibility for such exclusions to the States. The NWCG was not successful as of 10/6/89 when the proposed revisions were published for public comment. The revisions should be finalized in the near future at which time we will find out which option was chosen. A State could include prescribed fire emissions in the PSD increment if it so desires, even if exempted at the federal level.

The consensus of people knowledgeable in both prescribed burning and air quality that I have talked to is that southern fire managers should be more concerned about amendments to the Clean Air Act that are now being addressed by Congress. One suggestion being discussed would change the current particulate matter standard, which is based on a mass diameter of 10 microns, to one based on a mass diameter of 2.5 microns. Since a large proportion of the particulate produced by fire is even less than 2.5 microns, such a change would move fire up near the top of the list of particulate pollutant sources.

There is additional concern for global climate change linked to the release of CO_2 from biomass burning. However, the amount of fuel consumed annually by prescription fires in the Southern U.S. is minuscule compared to biomass burning in the tropics and subtropics. One consideration that favors the use of prescribed fire to reduce the damage from wildfires is that wildfires are a much larger source of emissions per acre burned.

CHALLENGES

Although prescribed fire can safely and effectively achieve many natural resource management objectives, it is no panacea. Under the wrong conditions, it can destroy the resources it was intended to protect. And there are tradeoffs associated with every fire that should be recognized and carefully weighed before a decision is made to burn.

Disposal of Logging Debris

Studies have shown that circular piles, although slightly more expensive than windrows, result in much faster burnout times, increase consumption of large materials, and significantly reduce smouldering combustion. However, care must be exercised both in piling and burning to minimize air quality impacts. The revised Prescribed Fire Guide (Wade and Lunsford 1989) gives a synopsis of the advantages of piling over windrowing. One error in the guidebook states that burnout can be speeded up by igniting the center of a pile. Under calm or light and variable wind conditions this may be true, but whenever wind direction is fairly steady, the upwind side of the pile should be ignited. From a nutrient and soil conservation standpoint, the obvious choice is to broadcast burn, but unconsumed material can present problems when machine planting. The disposal of logging debris in preparation for reforestation continues to be one of the more frustrating tasks fire managers face.

Trained Personnel

Crop trees, soil, and air continue to be damaged because some fire managers either misinterpret or ignore available information. Training courses are offered frequently, but all too often the people who need them most do not attend. Southern States have implemented a variety of programs to minimize episodes that have the potential to turn public opinion against prescribed fire. Most State forestry agencies did not look forward to regulating prescription burns, but they recognized that the alternative was even less palatable. Virtually all State and Federal natural resource agencies have pertinent daily weather and air quality forecast information available at their local offices. In Alabama the National Weather Service includes smoke

management parameters at the end of selected NOAA radio agricultural forecasts. Some States have instituted a prescribed burning notification or permit system which insures that people get this information before they ignite planned burns. Virginia FAX's the information to all forestry cooperators every morning.

Florida has gone one step further and offered to certify experienced prescribed burners who take a training course developed and put on by the State Division of Forestry (DOF). About 1,000 people have taken this training since it was first offered in 1988. A bill currently titled the "Florida Prescribed Burning Act" is likely to be introduced when the State legislature convenes this spring. Two principal tenets of the proposal are to require a certified prescribed burner to be on hand at any prescribed fire, and to absolve the burner from liability if damage results from a prescribed fire unless he/she is found to be negligent. The Florida DOF will take whatever steps are necessary to maintain quality control in the certification program.

Specter of Litigation

Most experienced prescribed burners can recall personal mistakes that could have had serious consequences. If lucky, we got by without incident and learned a valuable lesson. But how often will we be so lucky? Much of the preburn planning we should now be doing is designed to keep these mistakes from happening -- to reduce our dependence on luck. Anyone who is not devoting a lot of attention to smoke management is asking for trouble. If poor nighttime smoke dispersion is predicted, make sure your fire is out and stay until it is out! Residual smokes should almost always be mopped up instead of letting them burn into the evening. The best way to avoid blame for someone else's smoke is to make sure your fire is out before nightfall. Most Southern States have published smoke management guidelines and the Prescribed Fire Guidebook contains a screening system for managing smoke. A periodically updated version of the screening system is available to anyone with access to a computer. Monitor downwind conditions prior to and during the burn. Then check downwind and low-lying areas after the burn to make sure you don't have a residual smoke problem.

It is no longer acceptable to mentally evaluate the various factors in reaching a decision to burn. A written plan should be prepared, and done so before the burn takes place. Numerous plan forms exist; no one format is best. The Prescribed Fire Guidebook contains several sample forms, but you can devise one to meet your specific needs. If they are not parts of the plan, make sure that a map showing firing patterns, a copy of your smoke management calculations, and the weather forecast are attached to the plan. Record any changes you make in the plan along with the reasons for them.

The reason for all this documentation is simple. Statistics compiled by smoke management consultant Hugh Mobley show smoke from prescribed fires has allegedly caused 21 automobile accidents in Southern States during the past 10 years. These accidents resulted in 24 fatalities and 54 serious injuries. In case the worst happens and you find yourself in court, you will want to be able to prove that the problem arose from circumstances beyond your control (e.g., a busted forecast) and did not develop because of carelessness or an error in

judgement on your part. Be prepared to show that you took all appropriate steps to correct the situation once you became aware of it.

Toxic Effects of Combustion Products

One unwelcome news item fire managers need to be aware of is that "there is enough available evidence to suggest that the health of wildland firefighters may be compromised through...fire suppression activities." This statement is contained in a comprehensive study plan (USDA Forest Service and John Hopkins University 1989). According to Ward (in press), studies outlined in this document are being planned by the NWCG to provide the information necessary to evaluate risk management options. How this information relates to personnel on prescribed fires remains to be seen.

Aerial Ignition

The initial euphoria over aerial ignition has abated and many users have found that this technique, like most others, has its share of nagging problems. The cost of replacement parts for the surplus military helicopters commonly used is high. Contract services are a viable alternative, but scheduling can be a problem. Everyone wants to burn on the ideal days and no one wants to pay standby costs while waiting for burning conditions to improve.

COMING ATTRACTIONS

Whether we like it or not fire has played, and will continue to play, a major role in southern ecosystems. It is our responsibility as fire managers to use this tool to the best of our ability. As Bob Cooper used to say, "fire is a good servant but a poor master". Ancient Greek and Chinese cosmologies included fire as one of the basic forces governing our planet. In a captivating dissertation on this subject, Jennifer Robinson (1989) concluded that it is a mistake to exclude fire from modern cosmology. I'm convinced research results will continue to show fire to be an integral part of landscape ecology and a necessary ingredient in maintaining ecosystem health. Two older citations I feel compelled to mention are: (1) Craighead's (1977) recollections of the first forest survey in California where he observed that areas subjected to periodic "light" burning had much lower timber losses from bark beetles than unburned areas, and (2) Weaver's (1959) characterization of bark beetle populations on a Northwest Indian reservation as endemic in burned areas and epidemic in surrounding unburned forests.

What the collective "we" want our ecosystems to look like will have a major influence on fire management. The Southern U.S. is well suited to growing wood fiber and many landowners have capitalized on this fact. These landowners are often committed to evenaged management utilizing genetically improved trees. The trend in most public agencies on the other hand is toward unevenaged management. Prescribed fire is an integral component of both, but its application will differ. For example, the Osceola National Forest in north Florida expanded its summer burning program from near zero to about 8,000 acres in 1989 to more closely mimic the historic fire season.

Increased concerns about water and soil quality, such as those mentioned by Tom Welborn (this conference), suggest that fire will be chosen more often over alternative tools.

More stringent air quality regulations are inevitable in my opinion. They will likely force hard choices between conflicting laws because fire is necessary to perpetuate fire-dependent ecosystems, many of which contain species covered under the rare and endangered species act. My bets are on the ecologists. Whether the more traditional uses of dormant-season fire will be allowed could well hinge on how well we sell the use of prescribed fire as a wildfire reduction measure. Many instances can be cited in the South where prescribed fire has helped reduce the size, cost and severity of wildfires, but the conclusions reached are almost universally based on visual observations. In my opinion, adequate data upon which to make unbiased decisions do not currently exist. It is incumbent upon the fire research community to quantify the mitigating effects of periodic low-intensity fires upon the damage caused by wildfire.

Training of prescribed burners will continue to improve. The certification idea will grow; I would not be surprised to see the NWCG and the Southern Group of State Foresters heavily involved in such an endeavor. In spite of the high start-up costs in equipment and liability insurance, I foresee some forestry consultants deciding to specialize in prescription burning.

Smoke on the highway is an acute problem in the South. Research is certainly part of the answer. But I strongly believe that by coupling the information we already have with common sense and **mopping up** after every fire, we can greatly alleviate the highway visibility problem. One research product fire managers urgently need is better weather forecasts out 36 to 72 hours. It won't be long before some computer whiz uses topographic information in a GIS system to develop predictions of smoke drainage, both concentrations and area of involvement.

In summation, this is one prescribed burner who is heading by the store to pick up some more matches.

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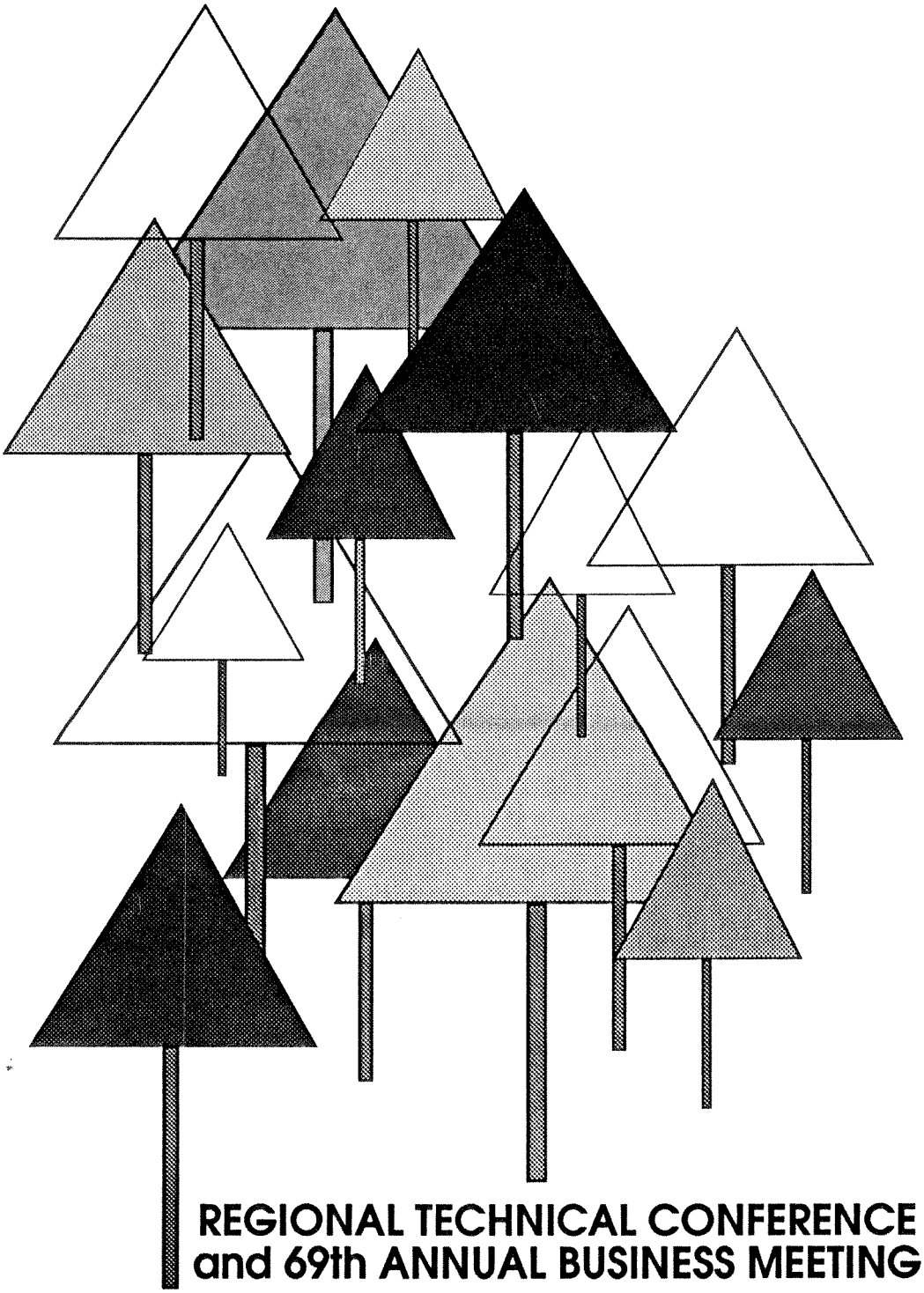
Forestry in the 1990's -

A Changing Environment



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